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10/757,007	01/14/2004	Yuuta Nakaya	FUJI 20.846	3290

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EXAMINER	
FOTAKIS, ARISTOCRATIS	

ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/757,007	Applicant(s) NAKAYA ET AL.	
	Examiner Aristocratis Fotakis	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 12/31/2008.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1 - 33 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1 - 33 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 09/21/2007.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Terminal Disclaimer

The terminal disclaimer filed on December 31, 2007 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US Application Number 10/754,815 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

Applicant's arguments filed December 31, 2007 have been fully considered but they are not persuasive. Applicants have amended the independent claims 1, 4, 32 and 33 to include the limitation of "selecting a branch outputting a largest signal level or a highest signal quality". The Examiner has cited and relied on Miyoshi as a combining reference to address the above limitation (please see more below).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

> the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 – 12 and 32 – 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng et al., ("Adaptive Beamforming of ESPAR Antenna Based on Steepest Gradient Algorithm", IEICE TRANS. COMMUN., VOL.E84-B, NO.7 July 2001) in view of Denno et al. ("*Performance and Configuration of M-CMA (Modified Constant*

Modulus Algorithm) Adaptive Array Using Polyphase Filters", ATR Adaptive Communications research Laboratories, Kyoto, 619-0288 Japan, 2002 Wiley Periodicals, Inc) and further in view of Miyoshi et al (US 6,622,013).

Re claims 1, 4, 32 and 33, Ohira teaches of a method of controlling an array antenna part (adaptive algorithm, Fig.4) having a plurality of antenna elements (M elements, Fig.1, Page 1791, Lines 2 – 7) arranged at a predetermined interval (radius of a circle R, Page 1791, Chapter 2, ESPAR Antenna Formulation, Lines 4 - 11), comprising: obtaining a predetermined evaluation function (cross-correlation coefficient, ρ, Page 1793, Chapter 4, Paragraph 3) with respect to each of weighting coefficients (equation 16, Page 1793) to be applied to incoming signals arriving at a plurality of antenna elements (M elements, Fig.1, Page 1791, Lines 2 – 7), by perturbing each weighting coefficient (Page 1794, Last Paragraph) at a sampling interval which is within one symbol time (*one frame of a training sequence of frames*, Fig.3, last paragraph); and adjusting each weighting coefficient based on the evaluation function (equation 17, Page 1794, First paragraph, Fig.4). However, Cheng does not teach of perturbing each of the weighting coefficients of the plurality of antennas at a sampling interval which is within one symbol time and does not specifically teach of selecting a branch formed by a plurality of array antenna parts outputting a largest signal level or highest signal quality.

Denno teaches of a M-CMA adaptive array using the polyphase filters (Fig. 4) where a four-element array antenna is been used (Fig. 5). To provide perturbation, an NCO (Numerically Controlled Oscillator) is used in this configuration. The interior of one symbol is oversampled by 2(N + 1) times, or twice the number of antenna elements +1, and then the samples are sent to N + 1 filter banks (Fig. 6). Each filter bank carries out its operation at twice the symbol rate. On the other hand, in synchronization, a perturbation is successively applied in 1/2 symbol to the variable phase shifter connected to each antenna element. Up to this point, the explanation has assumed the case in which perturbation is applied to all elements within one symbol of M = N + 1. As shown in Eq. (15), the value of M can be fixed. In the case of M = 2, it is possible to provide perturbation to one element for each symbol. In such a case, it is sufficient to use sampling at four times the symbol rate.

Miyoshi teaches of desired signal power detection sections (#109 to #116, Fig.3) t o measure a signal power level from a communication partner received at respective antennas (#101 to #108). Antenna set selection section (#117) obtains a sum of signal power levels from the communication partner received at four antennas belonging to each of antenna sets (A to D, Tables 1 – 3) each composed of combined antennas selected in advance to form a predetermined radiation pattern, for each antenna set (*branch*), and selects an antenna set (*branch*) with the sum being the highest (*largest signal level*). Switch (#120) connects received signals only from antennas belonging to the selected antenna set to reception RF sections (#121 to #124). Received signal inputted to respective reception RF sections (#121 to #124) are

converted into respective intermediate-frequency signals, combined in signal combining section (#125), and demodulated in demodulation section (#126) to be a desired signal (Abstract, Col 3, Lines 25 – 54, Fig.3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used M x oversampling for the M antenna elements in order to increase the speed of convergence of the steepest gradient algorithm. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used/selected the branch with the highest signal level in order to achieve excellent reception conditions in a short time.

Re claims 2 - 3 and 6 - 7, 9 – 10 Cheng teaches all the limitations of claim 1, as well as the antenna part comprising one active antenna element to transmit and receive a radio signal (0^{th} element, Fig.1, Page 1791, Chapter 2, Paragraph 1), and a plurality of passive antenna elements (M elements, Fig.1, Page 1791, Chapter 2, Paragraph 1) and variable reactances are loaded to the plurality of passive antenna elements (Fig.1, Page 1791, Chapter 2, Paragraph 1, Lines 8 – 18, equation 1), said method comprising: adjusting phases (Chapter 3, Fig.2) and amplitudes (Page 1793, Chapter 4, Lines 14 – 18) of incoming signals arriving at the plurality of antenna elements; converting an analog signal (discrete y(t) and r(t)) received by the active antenna element into a digital signal (y(n). r(n), samples) by sampling the analog signal at a predetermined period (Page 1793, Chapter 4, third paragraph, equation 15); and adjusting reactances of the

variable reactances to (Page 1791, Chapter 2, Second paragraph, Lines 8 – 14) minimize or maximize the evaluation function (*change of the cross-correlation coefficient*), by defining as the evaluation function a correlation coefficient (Page 1794, Col 1, Lines 16 – 21) which is obtained from a correlation of the digital signal (*y(t)*, Fig.1) and a known signal (*r(t)*, Fig.1) having a predetermined pattern (Page 1793, Chapter 4, Col 1, First and third Paragraph). However, Cheng does not teach of oversampling at a predetermined period.

Denno teaches of a M-CMA adaptive array using the polyphase filters (Fig. 4) where a four-element array antenna is been used (Fig. 5). To provide perturbation, an NCO (Numerically Controlled Oscillator) is used in this configuration. The interior of one symbol is oversampled by 2(N + 1) times, or twice the number of antenna elements +1, and then the samples are sent to N + 1 filter banks (Fig. 6). Each filter bank carries out its operation at twice the symbol rate. On the other hand, in synchronization, a perturbation is successively applied in 1/2 symbol to the variable phase shifter connected to each antenna element. Up to this point, the explanation has assumed the case in which perturbation is applied to all elements within one symbol of M = N + 1. As shown in Eq. (15), the value of M can be fixed. In the case of M = 2, it is possible to provide perturbation to one element for each symbol. In such a case, it is sufficient to use sampling at four times the symbol rate.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used M x oversampling for the M antenna elements in order to increase the speed of convergence of the steepest gradient algorithm.

Re claim 5, Cheng teaches of the control unit comparing the evaluation function ρ_n and a predetermined threshold value $\rho_n^{(0)}$, and adjusts each of the weighting coefficients $\partial\rho_n/\partial x_n$ depending on a compared result (Fig. 4, Page 1794, equation 18).

Re claim 8, Cheng teaches of a radio frequency processing part (calculation of correlation coefficient part) coupled to the plurality of antenna elements, and including said adjusting unit (determination of (x1...x6) part, Fig.1).

Re claims 11 - 12, Cheng teaches of the adjusting part of the control unit adjusting the reactances (determination of (x1...x6) part, Fig.1) of the variable reactances (phases and the amplitudes) to minimize or maximize the evaluation function (*change of the cross-correlation coefficient*) based on a gradient vector $\partial\rho_n/\partial x_n$ of the correlation function (Page 1794, Col 1, Lines 16 – 21).

Claims 13 – 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng , Denno and Miyoshi and further in view of Zhang (US 6,369,758).

Re claims 13 – 17, Cheng, Denno and Miyoshi teach all the limitations of claims 4, 6 - 7 except of the use of a base converter for converting a time-based digital signal into frequency domain and where the receiving apparatus is intended for a multicarrier system.

Zhang teaches of an adaptive antenna array for mobile communications where pseudo random training symbols and/or a constant modulus pilot carrier in OFDM symbols are used to train the adaptive antenna array to cancel unwanted multipath signals and suppress interfering signals (Abstract, Fig.1). The array antenna control apparatus comprises of a base converter (DFT, Fig.6) to convert a time-based digital signal which is described in a time-domain and output from said analog-to-digital converter (#16, Fig.1) into a frequency-based digital signal which is described in a frequency-domain (Col 14, Lines 48 – 65), said adjusting part (#22, Fig.1) of the control unit defining as the evaluation function a correlation coefficient (cost function, Col 5, equations 1 – 3) which is obtained from a correlation of the frequency-based digital signal and a frequency-based known signal (pilot carrier).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a DFT in order to demodulate the pilot subcarrier, thus eliminating the need for a full FFT to be done on each antenna output.

Re claims 18 – 19, Cheng teaches of the known signal (r(t), Fig.1) for transmitting control information within a frame (Page 1794, Chapter 4, Last paragraph, Fig.3) employed by a predetermined system or protocol (algorithm, Fig.4).

Re claims 20 – 31, Cheng, Denno, Miyoshi and Zhang teach all the limitations of claims 6 – 7 and 14 – 15. Cheng, Denno and Miyoshi do not teach of the profile-obtaining unit.

Zhang teaches of a profile-obtaining unit to obtain a delay profile statistically describing instantaneous characteristics of a transmission path (Col 4, Lines 60 – 67, Fig.1). It should be noted that multipath reflections (delayed signal) arriving in the receiver require a channel impulse response measurement in the profile-obtaining unit in order to obtain the delay spread in the power delay profile. The transfer function of the multipath channel is the frequency representation of the impulse response.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a profile-obtaining unit to obtain a delay profile of the multipath channel to suppress the unwanted multipath signals so as to steer towards the desired dominant signal path.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aristocratis Fotakis whose telephone number is (571) 270-1206. The examiner can normally be reached on Monday - Thursday 7 - 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AF

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SUPERVISORY PATENT EXAMINER